(1) What are the physical meanings of parameters a and b in the van der Waals equation? $p = \frac{nRT}{V - nb} - a(n/V)^2$ (10%) What is the principle of corresponding states? (5%) Express the van der Waals equation according to the principle of corresponding states. (10%)

(2) What is the dipole in a molecule ? (5%) What is the polarizability? (5%) What is the permittivity? (5%) What is the interaction between dipoles in a fluid of freely rotation molecules? Why? (10%)

(3) Utilizing the Maxwell distribution of speeds,

$$F(v) = 4\pi\left(\frac{M}{2\pi RT}\right)^{3/2} v^2 \exp\left(-\frac{Mv^2}{2RT}\right)$$

, to calculate the mean speed of molecules in a gas. (10%) Also, calculate the root mean square speed of molecules in a gas. (10%) What is the drift speed of ions in a solvent? (5%)

(4) Write down the polymerization of nylon-66 using the monomers $H_2N(CH_2)_6NH_2$ and $HOOC(CH_2)_4COOH$. (5%). What is the fraction, p, of –COOH groups that have condensed at time t? Assume the initial concentrations of both monomers are same, C_o. (10%) Calculate the degree of polymerization at time t. (10%)

You might need the integrals $(a > 0)$

$$\int x^n dx = \frac{x^{n+1}}{n+1} + \text{constant} \quad ; \quad \int_0^\infty x^n e^{-ax} dx = \frac{n!}{a^{n+1}}$$

$$\int_0^\infty x^3 e^{-ax^2} dx = \frac{1}{2a^2} \quad ; \quad \int_0^\infty x^4 e^{-ax^2} dx = \frac{3}{8}\left(\frac{\pi}{a^5}\right)^{1/2}$$

試題隨卷繳回